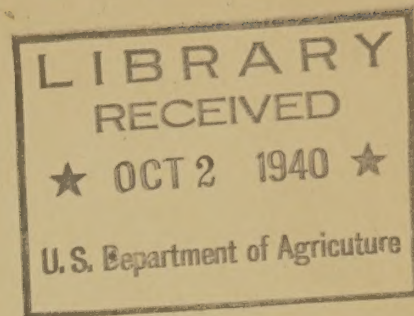


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UNITED STATES DEPARTMENT OF AGRICULTURE
Bureau of Agricultural Economics



A GUIDE TO COLLECTING, DESCRIBING, AND SUMMARIZING PRICE DATA

With Particular Reference to Historical Series of Local Market Prices

By

Arthur G. Peterson
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Completed in 1933 for use within the Bureau of Agricultural Economics, this guide is now issued for limited distribution among those engaged in price research.

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INTRODUCTION

Prices are the focal points of the workings of our economic system. They reflect and publicize the transactions that are taking place throughout the entire distributive process of our economy. Analysis of most economic problems deals with prices in one way or another. Therefore, it is important that our reporting of price movements be accurate and well-defined from the collection of the price data to the presentation in usable form such as averages and index numbers.

Price series should become known and advertised under more permanent and descriptive names. A full description of the commodity, the commodity unit used in quoting prices, the market area, terms of sale, representativeness of recorded prices, volume of sales at quoted prices, and a history of changes in the above-mentioned and any other important price-making factors, should be an accompaniment of every price series.

Statistical technique has been markedly improved during the last decade or two, and the immediate need seems to be for an improvement in the adequacy and reliability of quantitative data. The complementary relation between technique and adequate data is analogous to the alternate march of inventions and increased efficiency in spinning and weaving in eighteenth-century England.

The eccentricity of each problem will call for special treatment to fit its particular needs and objectives. It is believed, however, that certain fundamental standards of approach are of general application. Specific examples have been used to illustrate principles in an effort to indicate the practical significance of the principles. The writer realizes that there are many shortcomings in this preliminary outline and hopes that its weakness will prove its chief strength through inviting criticism of its defects. For instance, some reviewers think that it places too much emphasis on pricing by grades and specifications and too little emphasis on average prices.

An average price of many grades and qualities, even for an area as large as the United States, admittedly has many uses but a knowledge of the composition of the average is needed in scientific research. In the past, a general average price has often been the only series available. Now that the use of quality standards has greatly increased and more detailed data are being obtained, it seems appropriate to place special emphasis on the need for descriptions and specifications to provide greater comparability in price series from year to year.

M. H. OCT 15 1940

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PROBLEMS IN COLLECTION AND DESCRIPTION OF PRICES

A - Collection of Prices

A fairly definite plan of the project is a necessary prerequisite to the collection of price data. 2/ The scope of the project should be limited, and the procedure determined, in accordance with the objectives and the time and money available for the task. An historical study of prices in Virginia made by the writer in 1927 will be used in this report to illustrate some of the methods of proceeding with such a study.

The first step toward the proper execution of a research project should be for the personnel to study the relevant literature and to consult with experienced workers in the same field. In conducting a new study it is usually desirable, if not necessary, to make a preliminary survey of the field.

Before going into the field to collect historical price data, the worker should spend a short time in acquiring some knowledge of the historical development of the region and the industries to be surveyed. In following the course of prices, a general knowledge of the economic history of the particular region is helpful in many ways. Before the collection of price data in the field, contacts should be made with local leaders in the area from which data are to be secured. The sanction and cooperation of business leaders and journalists will facilitate the work of the field man, and will often help to uncover new sources of information.

Before beginning the study of prices of farm products in Virginia, letters were sent from the United States Department of Agriculture to bank

1/ This report was prepared in substantial conformity with an outline suggested by the Committee on Price Statistics of the Social Science Research Council, in 1931. Some members of that Committee reviewed the first draft of this report. Valuable suggestions were received from O. C. Stine and Morris A. Copeland; from Roger Hale and A. R. Sabin, now with the Agricultural Marketing Service. The report was revised in 1933 for use within the Bureau of Agricultural Economics. In response to special requests a few copies have been mimeographed for limited circulation among persons engaged in price research.

2/ See: Planning the Project, Research Methods and Procedure in Agricultural Economics, Social Science Research Council, Vol. 1, 1928, pp. 26-32 (mimeograph).

presidents and crop reporters throughout the State asking them to suggest names of farmers and business men in their communities who might have old records relating to prices of farm products.

Nearly all the letters were answered and each answer included from three to five names of persons who might have records of this nature. Letters were then sent to all those mentioned, asking if they had historical records of prices, the nature of their records, if they were willing to make them available to the Department of Agriculture, and by which of the following methods they preferred to make them available:

- (1) To copy the price data on forms which would be sent to them.
- (2) To send the account books or records to the United States Department of Agriculture, where the price data would be copied and the books returned to the owners by registered mail.
- (3) To have a representative of the Department of Agriculture make a personal visit and copy the price data from their records.

Some of the people who had only a few records of prices or who gave information of a general nature from memory, chose the first method. Records on prices, as quoted from memory, were not considered reliable enough to be included in the statistical analysis but a great deal of valuable historical information and some especially interesting letters were secured through this method.

A few chose the second method. Each was sent a Government franking slip with which to mail their books without cost to them. These books were then returned by registered mail as soon as the price data had been excerpted at the Washington office.

By far the largest number chose the third method. Six months were spent in the field by the writer, making personal visits to secure the price data from mills, stores, farmers, orchardists, fruit dealers, commission merchants, tobacco warehouses, and cotton gins, and through access to local newspaper files in newspaper offices, libraries, and court houses. Many new contacts were made in this way and these often led to finding new sources of material, since each person visited was asked to suggest the names of persons who were likely to have old records.

As near as possible, the plan followed in the field survey was to work in each crop district at a time when it would not interfere with the busy seasons of planting and harvesting. The work was completed in one crop district before moving to another. Price data were first obtained from all the sources that had been located through correspondence and any new sources located through these interviews. If sufficient price data were not secured in this way to give a representative average for each of the important crops in the district, a more intensive search was continued in one or more communities. Some centrally located or otherwise representative community was chosen for this purpose.

In collecting price data, a blank form was used for each 25-year period as follows:

1901-1925

PRODUCT SOLD _____ STATE _____ COUNTY _____
 SOURCE _____ NAME _____
 CODE NUMBER* _____ ADDRESS _____

Average prices to producers in _____
 (Place where sold)

_____ of each month _____ per _____
 Ct. or dol. Bu., ton, lb., etc.

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average
1901	:	:	:	:	:	:	:	:	:	:	:	:	:
1902	:	:	:	:	:	:	:	:	:	:	:	:	:
1903	:	:	:	:	:	:	:	:	:	:	:	:	:

* All price records were filed according to their code number. For example, 6-F-1 would indicate that this was the first set of prices secured from a farm account in District 6, and 4-N-2 would indicate that this was the second set of newspaper price data secured in District 4. After the field work was completed, all the price schedules for each commodity were arranged by price districts, for each of the 7 price districts, and according to original sources. The monthly price data were then transferred to individual commodity work sheets. The price districts corresponded to the United States Department of Agriculture crop districts which are numbered from the upper left to right. Virginia, because of its geographical shape, has its 7 crop districts numbered as follows: 2, 4, 5, 6, 7, 8, and 9.

Choice of Price Data

After locating the sources of price data one is usually confronted with the problem of selecting certain prices from a mass of data. Let us assume that we are starting to excerpt prices of farm products from a file of newspapers beginning about 1800. At first the problem is easy for there is but a single quotation or a narrow range of prices for each commodity. The single quotation, the average, or, if more detail is wanted, the range of quotations may be recorded.

The frequency of recording prices - that is daily, weekly, or monthly - will vary with the extent and frequency of changes in the price quotations,

and with the desired objectives. If a weekly price is wanted, it is desirable to record prices on a particular day each week, or perhaps as near the middle of the week as quotations are available. In recording prices once a month, prices should be recorded as of, or near, a particular day, as the 15th of the month.

After excerpting prices for a few years we are confronted with two price quotations for corn in October. "Old" corn is quoted at a premium of a few cents a bushel over "new" corn. Should we record the price of old or new corn, or both? The thing to do is to take a preliminary survey of price quotations for the next few years. Suppose we find that old and new corn are quoted separately only for part of October and for November, with a narrowing of the spread to about a cent a bushel in late November. Suppose also that upon consulting with some local grain dealers or farmers we find that new corn begins to be marketed in small volume about mid-October and that by mid-November when new corn is marketed freely, its quality is usually such that very little distinction is made between the price of old and new corn. It would then seem logical to record only the price of "old" corn for October, and to give a full description of this phenomenon in a footnote.

A few years later we may find different quotations for "yellow" corn and "white" corn, etc. We shall no doubt find an increasing number of price quotations for most commodities on the basis of grade distinctions.

Judgment is called for again and again in the collection of price data. A preliminary survey of the data and consultation with local business men, as suggested, coupled with some knowledge of the history of agriculture and marketing are essential to the exercise of good judgment in the collection of price data.

In excerpting historical price data we found that the price quotations for a commodity began to be split up on the basis of grade distinctions. The question arose as to how many and which price series to record. To decide these questions we should consider the scope and limitations of our project, and especially the purposes for which our price data are likely to be used. Perhaps it would be well at this point to discuss the nature and uses of various price series and to define a pure price series.

In compiling price series for detailed statistical analysis we should aim to secure as pure a price series as possible. A pure price series is a series of prices for a given quantity of a commodity of identical quality, at a particular place in a uniform market area, sold under constant terms of delivery and payment. In other words, a strictly comparable chronological list of prices.

Such a price series may be classed as too theoretical a concept for practical use in a dynamic world. However, the concept, even though never fully realized, is of decided value as a criterion and as a reminder of the imperfections in our chronological price comparisons. Future prices of wheat and cotton for certain periods may be considered as pure price series.

For practical purposes, and for want of better terms, we may classify our prices into micro- and macro-price series. A micro-price series, as the name implies, is usually representative of but a small universe and is of a specific, continuous identity. A macro-price series, on the other hand, is representative of a larger universe and is in the nature of a general or average price series. The distinction between the two types of price series is a matter of degree. The distinction, although clear at the extremes, tends to disappear as we approach the mean. Furthermore, a price series may be a micro-series for the purpose of statistical inference ^{3/} but must be classed as a macro-series when it is used for purposes of generalization to represent prices in a somewhat dissimilar universe; or what is designated as logical or inductive inference.

The more we purify our price series the more we limit the extent of their representativeness. As we become more meticulous and require prices which reflect minute quality distinctions and more specific market conditions, more and more price series are needed. These micro-price series should be rigidly defined and should be accompanied by a full description. A change in the commodity or in the market environment, beyond the limits of the definition of the given price series, will call for the termination of that series. It should be marked "ended" and a newly designated series begun.

Some commodities such as lambs, fruits, and vegetables, undergo seasonal changes in quality. Grade specifications for price series of such commodities should be flexible enough to permit the continuation of a price series throughout the season. A description of the normal seasonal variations should accompany each price series.

More general requirements will extend the representativeness of, and permit a greater longevity to, the price series. A general average of all commodity prices is the extreme form of a macro-price series, and one which can go on forever.

Although chief emphasis has been placed on obtaining detailed descriptions and specifications of price series so as to provide comparability, general average prices will still be needed for many purposes. When such averages cannot be satisfactorily computed from the more numerous detailed series, they may best be compiled as averages in the form of originals rather than derived series.

Sometimes a long-time series of prices is wanted for a commodity which has served the same general purpose over a long period of time although the commodity itself has undergone many changes in quality and composition. The average price of Ford automobiles since 1900 may be an interesting and useful series for certain purposes although there is little comparison between the first Fords produced and those produced today. Again we may want to know the average price paid by farmers in the United States for grain drills despite the variations in size and quality at a given time as well as from year to year. In cases like these, when there is a demand for a long-time price series, or for a convenient overall summary figure, a general average price will be needed.

^{3/} Research Methods in Agricultural Economics. Ibid. Vol. II, p. 271 ff.

Before leaving this discussion of micro- and macro-price series, let us examine a particular case to illustrate how important it is to disintegrate our price series. Egg marketing affords a striking example of vertical and horizontal variations in grades and prices, and the need for recording separate price series by grades for specific markets or stages in the marketing process. Numerous changes have been made in egg standardization since the adoption of United States standards of quality for eggs at the national conference of the egg trade held in Chicago, January 19, 1925. 4/

It is not difficult to recollect the time when we had but two kinds of eggs - "good" and "bad" - (edible and inedible) - and when the classification was left to the consumer. The delight of observing the Janus-faced lumber camp cook in his one timorous moment when he cracked eggs over the frying pan is now all but forgotten. From this situation the classification of eggs was pushed to the other extreme and 41 different grades or classes of eggs were recognized on the New York Mercantile Exchange until February 14, 1932 when this number was reduced to 23 through simplification of market standards.

Eggs are classified, according to United States Standards, on the basis of five quality factors, i.e.: shell, air cell, yolk, white, and germ and are also classified according to size or weight. In the highly commercialized egg-producing sections of New Jersey where eggs usually are marketed within 24 hours of the time they are laid, the above-named quality factors are too uniform to serve as a satisfactory basis of classification, and the weight of eggs is the principal basis of grading.

There are three distinct stages in the movement of eggs from producer to consumer, namely:

- (1) From the producer through the local buyer to the country packing plant or car-lot shipper.
- (2) From the packing plant or car-lot shipper through the wholesale market receiver to the jobber in the distributing markets.
- (3) From the jobber through the retailer to the consumer.

To meet the trade needs at each of these three stages or markets, the United States Department of Agriculture has formulated three sets of grades for eggs, namely: United States Buying Grades, United States Wholesale Grades, and United States Retail Grades. The United States Buying Grades are relatively simple and easy to apply, as country egg buyers do not as a rule have the time or candling experience for closely grading eggs into wholesale or retail grades.

4/ For reference see: 1- EGG STANDARDIZATION LEAFLET NO. 2, United States Department of Agriculture, Bureau of Agricultural Economics, first issued, October 1925, first revised May 1929. 2- SPECIFICATIONS OF THE UNITED STATES STANDARDS AND TENTATIVE UNITED STATES GRADES, Bureau of Agricultural Economics (Mimeographed report). 3- UNITED STATES STANDARDS AND GRADES FOR EGGS, - Chart showing standards of quality for individual eggs, United States Department of Agriculture, Bureau of Agricultural Economics. 4- The Significance of Measurements of Quantity and Quality of Egg Yields, New Jersey Agricultural Experiment Station Bulletin No. 528, July 1931.

More of the eggs are now being bought at country points on the basis of quality than formerly, owing to an increase in the practice of grading and increased volume of buying by farmers' cooperative organizations. Paying producers on the basis of quality is happily becoming more general, but progress is slow at best and its expansion seems definitely limited by the fact that country storekeepers, who do not candle eggs, are likely to continue to buy a large proportion of eggs at country points because, in an exchange for merchandise, they can afford to allow 1 to 2 cents more per dozen than cash buyers.

Eggs classed as United States Extras in the Buying Grades are, in the United States Wholesale Grades, reclassified into United States Extras and United States Specials and these two standards are further subclassified into four grades each, which are later reduced to two subclasses in the United States Retail Grades. In order for a price series of United States Extras under United States Buying Grades to be strictly comparable with a wholesale price series, the latter would need to be a weighted average price of the eight subclasses or grades. However, once a rather definite differential has been established between one of the more narrowly defined wholesale grades of "extras" and the more inclusive buying grade of "extras", the former may readily serve as a basis for establishing prices paid to producers. Retail sales of eggs are usually made on the basis of "not-well-defined" brands, which are private property of respective retailers.

The quality of product sold under poorly defined brands or trade names may be changed at the pleasure of the retailer, whenever such a change promises to yield a larger profit by capitalizing on the value of the advertised brand. This makes it difficult to compare retail prices with wholesale or country-point prices of graded eggs and consequently retards the reflection of changes in consumer demands back to producers through the price mechanism. 5/

Sampling

"The theory of samples - their probable errors and legitimate use - is a chief topic of modern scientific statistics", according to Karl Pearson. Unfortunately sampling is a rather technical problem. Only a brief treatment of this subject is given here along with a few specific examples to suggest methods which may be applied in order to obtain a representative

5/ A large proportion of retail chain stores, especially the larger ones, are strong advocates of private-brand merchandise. A study of a large number of chains in 1931 indicated that stores owning private brands did 81 percent of the total business of the reporting chains. Private-brand sales represented about 28 percent of the total sales of private-brand owning chains. For a detailed discussion, see Chain-Store Private Brands - Senate Document No. 142, pp. XIII - XV. Letter from the Chairman of the Federal Trade Commission transmitting in response to Senate Resolution No. 224 Seventieth Congress, report of the Federal Trade Commission Relative to Chain-Store Private Brands. Washington, 1933.

sample at a minimum expenditure of time and money. For a fuller discussion of sampling the reader is referred by the footnotes to several of the standard texts and other publications which deal with sampling technique.

In any sampling problem one should first study the frequency distribution of the price data from which prices are quoted. A frequency distribution is a summarization of the number of each of the different values of a single variable attribute within a statistical group. For example, let us illustrate by the grouping of the average farm price of wool in each of the 46 States reported on March 15, 1932.

Price per pound	Number of States	Number of States illustrated graphically
<u>Cents</u>		
9	2	= =
10	4	+ - - -
11	5	= = = = =
12	7	= = = = = = =
13	9	= = = = = = = = =
14	5	= = = = =
15	8	= = = = = = = =
16	5	= = = = =
17	1	=

In economic data it is frequently impossible to get a complete observation of all the cases within the scope of the universe of inquiry. Even where complete observation is possible, it is often impracticable. Partial observation or sampling permits great saving in time and effort in statistical inquiries, and the results may be just as valid as if the analysis were based on a complete enumeration.

When sampling is resorted to, the collection and use of the sample data should be accompanied by tests and checks to determine the adequacy of the data for various purposes. This subject has been ably treated by Sarle and Hale. 6/ What constitutes a representative sample? How can we obtain a representative sample? How are we to know when we have sufficient observations to make our sample truly representative? If our sample is not

6/ Charles F. Sarle, Reliability and Adequacy of Farm-Price Data, United States Department of Agriculture Bulletin 1480, March 1927; Adequacy and Reliability of Crop-Yield Estimates, United States Department of Agriculture Technical Bulletin No. 311, June 1932, pp. 12-39; Research in Prices of Farm Products - Scope and Method - Social Science Research Council, Bulletin No. 9, June 1933, pp. 13-29 on "The Collection and Organization of Historical Series of Local Market Prices and Related Data" by Roger F. Hale and Charles F. Sarle.

fully adequate, or is not based on random sampling [7] to what extent are we justified in applying the theory of probability, and to what extent can we safely generalize on the basis of such a sample? This last question is one of increasing importance, but unfortunately is a question which statisticians are as yet unable to answer satisfactorily.

A representative sample is a sample which contains the same proportion of the various attributes as the larger universe from which the sample is drawn. The objective of a study may be limited to a consideration of certain variable characteristics of the universe. A sample may then be representative of the specified characteristics of the universe, without being representative of the characteristics in toto.

The size of sample required to insure representativeness depends on the size of the universe and the character of the frequency distribution of the individuals in the universe. The smaller the universe and the more skewed the frequency distribution, the larger must be the sample in proportion to the universe. A sample may be considered sufficiently large when the addition of more units does not appreciably alter the result. One or two prices of a standard commodity may be sufficient whereas a dozen or more prices of certain fruits and vegetables might be necessary to provide a representative sample.

Simple or random sampling conditions are of rare occurrence in our economic data because of the varied and complex conditions. It is, therefore, usually desirable to subdivide our universe of inquiry and to study each group separately in order to secure greater homogeneity and more appropriate use of the theory of probability. From the purely theoretical or mathematical point of view, the theory of probability applies only to random sampling and is inapplicable if our sample does not meet the requirements of random sampling. Such a rigid limitation of the theory of probability in practice would, however, largely destroy its usefulness in economic analysis. While some are too meticulous in theory, many others are too careless or uninformed and consequently indulge in too extensive use (or abuse) of the theory of probability.

A position somewhere between these extremes would permit of maximum serviceability of sampling theory applied to economic data. When the deviations from the requirements of simple sampling become so great as to impair seriously the usefulness of the results for the objective in mind, it will then be necessary to test our sample by empirical methods instead of by mathematics. The many misforecasts following the downturn in business conditions in 1929, was followed by increased practical use of empirical testing of statistics by checking various data with other related statistical series and historical events.

[7] A random sample is a sample, in the derivation of which, every unit within the universe of inquiry has an equal chance of being drawn, and the drawing of any unit does not influence the drawing of an additional unit. For a discussion of sampling, see: G. U. Yule's Introduction to the Theory of Statistics, 1927, ch. XIII, on simple sampling of attributes. F. C. Mills, Statistical Methods, 1924, pp. 548-61. Research Methods and Procedure in Agricultural Economics, Vol. I, pp. 49-57. J. M. Keynes, A Treatise on Probability, 1921.

Most economic problems do not lend themselves to random sampling. Our sampling is therefore more often associated with the exercise of judgment in order to obtain a representative sample at less expense. Picking every fifth or tenth observation in the universe, or what Professor Crum calls "sampling by design" is intermediate between random sampling and "selected sampling." Choosing or selecting typical prices may permit of securing a more representative sample than could be obtained at a given expenditure of time and money by resorting to random sampling. As we deviate from random sampling, such measures as probable error and standard deviation become less applicable, and if applied as a guide, must be applied with reservations with due regard to the limitations on the interpretations which can safely be made from such analysis. 8/9/

The aim in sampling should be to obtain a sample which will be just large enough to contain the same proportion of all the relevant variables, as exist in our universe of inquiry. A representative price for a region may be chosen on the basis of judgment alone, or with the aid of mathematics to test the representativeness of our sample and to compute an average price. Sometimes good judgment alone is sufficient and sometimes the time and means allowed do not permit mathematical testing.

Tobacco has perhaps more grade classifications than any other farm product with 66 standard grades of the fire-cured type alone. In collecting historical prices of fire-cured tobacco in Virginia the writer, upon finding newspaper quotations for as many as 20 grades and knowing little or nothing about unmanufactured tobacco, handled the problem as follows: 10/

Tobacco prices were quoted in the Lynchburg newspapers from 1814, but were not quoted by grades until 1826. From the opinions of tobacco warehousemen and from an observation and comparison of actual average auction sales prices with newspaper grade quotations over an 11-year period, 1894-1904, it was found that the medium leaf grade was the grade which most nearly represented the actual average auction sale price. After 1904 newspaper tobacco quotations were discontinued, but from 1894 to 1904 the price range within the medium leaf grade usually included the actual average auction sale price. Because medium leaf grade represents closely the average price of dark tobacco, prices were obtained for this grade about the 15th of the month, for the months of November, December, January, February, and March, 1826-1893. For any particular year in which a very large or very

8/ See Yule, *Ibid.*, ch. XIV, on the "effect of removing the limitations of simple sampling."

9/ Yule, *Ibid.*, pp. 279-81. It should also be kept in mind that even in random sampling, the probable error and standard deviation do not establish or designate the specified probable variations, except insofar as the variations are due to fluctuations in sampling and not to errors in the data. If our data are subject to inherent or artificial bias or errors in classifications, the probable errors of estimate may be much greater than indicated by the standard error of estimate.

10/ Arthur G. Peterson. *Historical Study of Prices Received by Producers of Farm Products in Virginia, 1801-1927*, Blacksburg, Va., 1929, p. 65.

small proportion of the crop graded as medium, depending on the general quality of the season's crop, this price would not be quite as representative as in a year with an average quality crop. But grades were not so well defined then as now and it is probable that the grade specifications varied with the quality of the crop and that these prices represent very closely the actual average price of dark tobacco during the period, 1826-1892.

B - Describing price data

a - Concerning the commodity

(1) Trade Unit

An exact definition of the unit for which the price of any commodity is quoted, is perhaps of first importance. Such a definition should give particular attention to unit characteristics which are price-determining factors. Consideration should also be given to identification characteristics which may be relatively unimportant in the determination of prices at that particular time or place. Current prices for many goods are quoted for units which are in common usage and we often overlook the importance of relating the price to a definite quantity. Failure to do this results in one of the greatest difficulties in historical price research, or what Beveridge calls "post mortem analysis." 11/

Historical variations in units should be noted to facilitate long-time price comparisons. The bushel, for example, has undergone numerous time changes, referring sometimes to a "heaped bushel", which varied not only with the circumference at the top, but also with the height of the heap. At other times the bushel referred to a "struck bushel" (level with the top of the basket) and now the bushel generally refers to a certain weight, which may have been changed from time to time, and which may now have considerable geographic variation.

The Virginia Colony maintained an export duty on tobacco of 2 shillings per hogshead from 1661 to 1769, but during this time the size of the hogshead increased from 500 pounds to 900 pounds, thus effecting a reduction in the duty per pound by increasing the size of the hogshead rather than by reducing the tax per hogshead.

In addition to shifts in size and/or contents of containers, the inclusion of containers in price quotations may affect the comparability of historical price series. This may be a significant factor if the container is included in some and excluded in other price quotations, especially if the value of the container is fairly large in relation to the value of its contents. The difference in price per unit of a commodity with or without container may often exceed the price of the container

11/ See: 1 - A Statistical Crime of the Seventeenth Century by W. H. Beveridge, Journal of Economic and Business History, August 1929. This article is an interesting economic detective story; illustrating what constitutes historical research of the first order. 2 - Wheat Measures in the Winchester Rolls, Sir W. H. Beveridge, Economic History, No. 5, January 1930.

because of packing costs. Commodities sold in containers may be of better quality for there is a tendency to pack only the better grades. In some cases grain sacks or milk bottles, for instance, are acquired by the purchaser of their contents and the seller may give a customer an allowance for the return of empty containers. In other cases an extra charge or deposit may be made for the container.

If the weight of a container is fairly large in relation to the weight of its contents the price comparison may need to be made on the basis of net weight of the contents. Owing to variation in value and quantity of liquids mixed with solid contents it may be practicable to compare prices on a drained weight basis for such items as canned goods.

Time changes in commodity units are more numerous and more frequent in the case of machinery and other manufactured products than in the case of raw materials. A complex unit such as a machine usually undergoes marked changes every year and frequently undergoes minor changes within the year. Such changes may be classed as changes in the commodity itself, and will be discussed later under "Commodity Description."

Geographic differences in units of the same name are particularly confusing unless accompanied by a description adequate to facilitate accurate comparisons. Shelled corn is usually bought and sold on the basis of the 56-pound bushel in the United States, in accordance with Federal Statute. But corn is not always sold as shelled corn nor is shelled corn always sold by the bushel. Most of the States have legalized the bushel of ear-corn as a 70-pound bushel, except Mississippi with 72 pounds and Ohio and West Virginia with 68 pounds. In Texas, the bushel of ear-corn for new crop is 72 pounds until December 1 when the 70-pound bushel applies to both new and old corn. Bushel weights for "corn in the ear, unhusked" have been established for some States, ranging in weight from 70 pounds in Florida to 75 pounds in Alabama and several other States. In eastern Virginia and Maryland corn prices are usually quoted per barrel of 5 bushels of shelled corn and 9-10 bushels of ears; thus if one asked the price of corn the answer would undoubtedly be \$2.00 when corn was selling at 40 cents a bushel.

In the Shenandoah Valley of Virginia ear-corn is sometimes exchanged on the basis of a 1-1/2 bushel-barrel of 105 pounds or a 3-bushel barrel of 210 pounds. Newspapers in Staunton, Virginia, for a long time, recorded corn prices in terms of the 1-1/2 bushel-barrel of ear-corn without referring to the unit; indicating that it was at one time the common unit of corn exchange there.

South Carolina and Tennessee laws specify "Corn, green, with shucks" having 100 pounds per bushel and 2-1/2 bushels per barrel.

Wheat, shelled corn, rye, oats, flaxseed, and peas are about the only commodities whose weight per bushel is prescribed by Federal Statute with uniformity between all the States in the Union. Although the Constitution of the United States authorized Congress to "fix the standard of weights and measures," and in spite of Washington's and Jefferson's

recommendations to Congress to that effect, no general national legislation of this character has yet been enacted. The legal weight per bushel for buckwheat, for instance, varies from 40 pounds in California to 56 pounds in Kentucky, with a range from 48 to 52 pounds in all the other States. Onions vary from 50 to 57 pounds per bushel as between States; salt from 50 to 80 pounds; and tomatoes from 45 pounds per bushel in Missouri and Oklahoma to 60 pounds in Virginia and Maryland. ^{12/} The smaller these unit differences, the more likely they are to be overlooked or ignored in making price comparisons.

Prices should be recorded in terms of the unit used in commercial transactions. Where potatoes, for example, are sold by the bushel rather than the 100 pounds, prices should be recorded in terms of bushels. In some cases and for some purposes bushel prices can later be converted into 100-pound units. Irish potato prices in Virginia are reported both in terms of prices per barrel and prices per bushel. It happens that the barrel prices are reported from, and are representative of, the surplus, early potato-producing area in eastern Virginia, while the bushel price reports correspond closely to the non-surplus, late potato-producing areas in the State. By combining these barrel prices and bushel prices to get an average price for the State, our combined series would not be representative of either early or late potatoes or of surplus or non-surplus producing areas. However, conversions of this kind are often necessary to obtain a combined series in terms of the same units for a large geographic area.

Rice has various geographic trade units in this country, making it necessary that the Bureau of Agricultural Economics record prices of southern rice in terms of at least two trade units. For milled rice the "pocket" of 100 pounds is generally used throughout the United States, whereas exports are usually recorded in terms of "double pockets" or 200-pound units. For rough rice, the barrel of 162 pounds and the 183-pound bag are both used in Texas and Louisiana; the 100-pound bag in California; and the 45-pound bushel in Arkansas. The early Arkansas rice growers who migrated from the North some 30 years ago brought with them not only a Republican platform, but also a bushel-mindedness from the oat fields of Illinois and Iowa and superimposed them on the rice fields of Arkansas.

A consideration of milk prices will help to illustrate the importance of associating a per unit price with its related market conditions. The local market prices of milk as collected by the United States Department of Agriculture were on a gallon basis from January 1910 to August 1923 and in September 1923 were changed to a price per 100 pounds.

There was an abrupt break in the comparability of prices of milk in 1923 when the unit for price recording was changed from a gallon to a 100-pound basis. This resulted partly from the accompanying shift in the source of price data from areas where the gallon unit was used, and partly from the fundamental differences in the kind of prices represented by the old and new price quotations. When milk prices were asked for, on a 100-pound basis, prices were reported more by the large milk producers and

^{12/} Federal and State Laws relating to Weights and Measures, Bureau of Standards, Misch. Pub., No. 20, Washington, 1926, pp. 933-41.

dealers who exchanged large quantities on a 100-pound basis at wholesale prices. Large producers who had sold partly on a gallon basis to retailers and partly on a 100-pound basis, to wholesalers, tended to report the relatively higher gallon prices when prices per gallon were asked for, and to report the relatively lower prices per 100 pounds when prices were asked for on that basis after August 1923. The former small producers and retailers dealing customarily in gallon lots were, for the most part, replaced, as price reporters, by the large producers and wholesalers.

Individual trade units sometimes vary between retail and wholesale markets. Higher prices tend to be associated with smaller unit sales, particularly where small-lot or retail prices included charges for additional service. Transportation costs per identical unit are also higher for small transactions, less than carlot quantities for example. Many of the costs that enter into the selling prices do not vary in proportion to the volume of sales. Certain costs are of a fixed nature, with a tendency for costs of distribution and selling prices per unit to increase as the size or volume of transactions decreases. It is, therefore, important to accompany the price series with a description of the character of the market in which prices are recorded. In cases where the price per unit is reduced for successive increases in the aggregate unit of purchases, it may be desirable to classify sales into two or more groups of similar sized orders with a separate price series for each group. 13/

Shortages and overages in weights of retail sales, although seldom apparent, are real differences which may be of considerable significance in certain price comparisons. This factor has generally been neglected in most retail price analyses.

In a study made by the Federal Trade Commission it was found that 50.3 percent of the purchases from chain grocery stores were short in weight and 34.1 percent overweight compared with 47.8 percent and 43.8 percent respectively in the case of independent grocery stores.

On the average, individual purchases from chain grocery stores vary less from the declared weight than in the case of independent grocery stores, but a buyer is likely to be short-weighted more times and by a greater amount, on the average, by the chain grocery than by the independent grocery. 14/

"--- the total net shortage (the difference between total quantities short weight and overweight) on all items purchased from chain stores was slightly over three-tenths of 1 percent (0.321 of 1 percent) of the total quantity bought, as compared with a net overage for independents of 0.143 of 1 percent. The overages and shortages from cooperatives exactly balanced. Combining the cooperative and independent dealer purchases the result is a net overage of 0.096 of 1 percent.

13/ See also the discussion on "Volume of transactions" p.27.

14/ Chain Stores, Short Weighing and Over Weighing in Chain and Independent Grocery Stores, Senate Document No. 153, p. x. Letter from the Chairman of the Federal Trade Commission transmitting in response to Senate Resolution No. 224, Seventieth Congress, report of the Federal Trade Commission relative to short weighing and over weighing in chain and independent grocery stores. Washington. 1933.

"While the size of the shortage for chains may seem insignificant to many, it would amount to 3.41 percent on the investment in these bulk commodities, figured on the basis of the average stock turn (turn-over) of grocery and meat chains of 10.61 times per annum." 15/

(2) Description of Commodity

As the market for wheat became a world market it became necessary to adopt a universal wheat language having definite units and standard grades. In the old days when commodities and news traveled together in sailing ships, there was less need for standardization, for goods were bought and sold on the spot where they were inspected. The advent of the mail steamer and later development of the telegraph and trans-oceanic cable service allowed news to travel much faster than material goods. The purchase of goods "in transit" or "to arrive" and the pressure of future contracts with the acceleration of business activity and the desire to eliminate uncertainties, have revolutionized many commercial practices. Organization of the telegraphic market for news service for fruits and vegetables helped to bring about the adoption of a common language in the form of Federal standards. The purchase and sale of goods in large quantities by commission merchants or transfer by brokers has necessitated the use of samples or standardized description.

Rapid growth of Government market news reporting since the creation of The Office of Markets in May 1913, 16/ and especially since establishment of the Bureau of Agricultural Economics in 1922, has made it necessary to promote the establishment of national standards for farm products as a basis for price reporting.

Growth of standardization, Government inspection, and market news service with comparable price quotations has developed a price sensitive-ness which permits of more ready adjustment of production to changes in consumers' demands. Not only have price quotations necessarily become more numerous, but they have become more serviceable both as an indication of value and as a basis for exchange operations. In the early days, information in regard to markets was usually collected separately by individual traders for their own use. About 1858, Mr. Urner established a market news reporting service in New York City and began the weekly publication of the Producers Price Current, which was changed to a daily report in 1882. 17/

Until about the time of the World War, however, our market news was still of private origin, supplied at private expense, to serve private ends, 18/ and needless to say, it was often unreliable and generally inadequate.

15/ Ibid.

16/ C. B. Sherman, History of the Bureau of Markets, printed in W. A. Shermans' Merchandizing Fruits and Vegetables, 1928, pp. 151-62. The Office of Markets was created by the Secretary of Agriculture under authority granted in the agricultural appropriation bill for the year 1914. The Office of Markets was superseded by the Office of Markets and Rural Organization in 1915, by the Bureau of Markets in 1917, and by the Bureau of Agricultural Economics in 1922.

17/ F. E. Clark and L.D.H. Weld, Marketing Agricultural Products, 1932, pp. 343-44.

18/ Wells A. Sherman, Merchandizing Fruits and Vegetables, 1928, pp. 179-81.

A detailed description should be given of the commodity and the quality or grade for which prices are recorded. A good description of a commodity for purposes of price quoting should specify as clearly as possible those characteristics which are important in determining the price of the particular commodity. Statistics on exports, for example, because of frequent large group classifications, do not state the variations in the relative amounts of different quality products within a given group from time to time. A higher average value of a composite unit may be due to a larger proportion of better grade products; thus not representing a real increase in price, and perhaps even a decrease in the price of identical units.

Grade, and its corresponding price, should furnish the information desired by buyers and producers. A buyer of apples, for example, will want a different quality of apples for table consumption, than for canning or for manufacturing into vinegar. Tobacco manufacture, because of its specialized character, calls for detailed qualitative distinctions of leaf tobacco for various uses. There are now in the United States about 71 standard grades of flue-cured tobacco, 68 grades of air-cured (Burley) tobacco, and 66 grades of fire-cured tobacco.

The determination of the important price-making factors requires a careful study of market demands coupled with quantitative analysis of these factors in particular markets. F. V. Waugh's study of "Quality Factors Influencing Vegetable Prices", in the Boston market is one of the first detailed studies of this kind. 19/

Historical price series may lack comparability for reasons other than those mentioned elsewhere in this report. The tendency toward continual improvement in quality of products may result in historical bias in prices and other statistical series. This is more often the case with manufactured articles than with farm products and raw materials generally. Major improvement in a commodity, particularly if associated with a change in its size or shape tend to be - and more often should be - taken account of in describing price series. However, the small and less conspicuous changes in quality of a commodity are generally ignored in continuous price series, thus giving such series an upward bias. Fluid milk, rubber tires, refrigerators, and automobiles are conspicuous illustrations. Conversely, if the quality of a commodity deteriorates, its price series may have a downward bias.

The development of inspection and grading of raw and processed farm products undoubtedly has brought about an improvement in quality of many products sold in the market place. With the passage of time more and more sub-standard food products are barred from sale or diverted to nonfood uses. Elimination of the poorer quality products tends to lessen the range in quoted prices. A century ago most of the butter was made on farms and a

19/ Journal of Farm Economics, April 1928, pp. 185-196. Mr. Waugh has determined the relative importance of certain quality factors and the average price differentials associated with variations in individual quality characteristics for asparagus, tomatoes, and hothouse cucumbers in the Boston market in 1927.

wide range was characteristic of butter-price quotations in newspapers and other records. Today the range in prices of 88 to 92-score butter is relatively small. The price of 88-score butter is about 28 cents when 92-score butter is 32 cents a pound, a simple average of these being 30 cents. A century ago some butter was quoted at 18-30 cents per pound or an average of 24 cents for the high and low quotation. The recent 30-cent price probably is much more comparable with a top price of 30 cents a century ago than with a 24-cent average of a high and low price at that time.

Not all price factors are capable of quantitative measurement and in many cases no measure of certain attributes has been established. The present United States wool standards are based wholly on diameter of fiber. Other factors such as length of fiber, spinning quality and amount and character of shrinkage also influence wool prices. These factors, however, usually affect values in a positive relation to the diameter of the fiber. Consequently grade distinctions are not always correlated with differences in price. It is of comparatively recent date that protein content was incorporated into the distinction between wheat grades. Not all minor price-determining factors need be described.

Identical products are often sold under different names at widely different prices. Highly-advertised products command prices as much as 600 percent more under their trade names than under their "official" names. In such cases it is the highly-advertised trade name which, because of the ignorance of consumers, is the chief price-determining factor. In reporting prices of such products, the trade name is a sufficient description, partly because it is well known, but chiefly because it is the name and not the intrinsic value which determines its price.

The task of exact description of commodities cannot always be left to the unaided price collector. Laboratory research and market studies by commodity specialists are needed to establish market grades. When prices are quoted for standard grades, the task of the price collector is much easier. When no such grades exist he must supply the necessary description as best he can. Even where standard grades are used, these sometimes only prescribe the lower limit or minimum requirements. The price collector should then endeavor to take prices for the average or model group of commodities within the grade and give a full description of the sub-grade which serves as a basis for his price quotations.

A good price collector or recorder should ask himself frequently: "What are the chief characteristics of this commodity which determine its price?" "Has there been any change in grade classification, trade labels, trade marks, brands, condition of containers, source of production, chemical and physical properties of the commodity which are recognized as important price-determining factors?"

The answers to some of these questions may seem to be too obvious to warrant recording them. But if we stop to think that price analysts and historians will be using these data 50 or a 100 or more years hence, we can justify recording in considerable detail the relevant factors which at the moment may seem obvious to all interested parties. The slow changes in price-making factors, which are not easily recognized at a particular time,

are of vital importance in connection with the historical analysis of price data, such as the long-time trend toward an increase in the sugar content of sugar beets, and the long-time quality changes in wool with a reduction in shrinkage, an increase in the length of merino wool, and a decrease in the fineness or diameter of wool fiber. The secular changes brought about by growth or changes in consumption habits are sometimes overlooked until they become quite prominent. A detailed description of change in commodity transactions will help to trace back the gradual changes to their inception. In this way it will also be easier for the analyst to inquire into and determine the causes and effects.

Different geographic regions supply a commodity with special qualities, and regional names have often been employed to designate a certain quality, for example, Turkish tobacco, Swedish iron, California oranges, and Virginia ham. With the growth of well-defined Government or trade standards on a scientific basis, the old regional trade names have lost most of their significance. The transfer of plants and animals from one country to another, and extensive scientific plant and animal breeding during the last century, have tended to break down the significance of early trade nomenclature.

Brazil rubber was once a significant term, not so much because the rubber tree was indigenous to Brazil, but because Brazil was for a long time the only important source of para rubber. The term "Brazil rubber" fell into disuse as Brazil became of minor importance as a rubber-producing country. Here the name generally has been replaced, without any marked change in the quality of raw or untreated rubber.

On the other hand, there are many instances where the nomenclature has remained the same while the commodity in question has been greatly changed and while an entirely new system of classification may have been superimposed. The long-staple cotton grown in the bends of the Mississippi was long considered the most valuable and came to be known by the name "benders". Cotton grown in the basins of the rivers tributary to the Mississippi was of somewhat less desirable quality and became known as "rivers", and the cotton grown on the poorer soil along the small streams was called "creeks." ^{20/} Some of these trade terms such as "benders" and "bodes" are still in fairly common use in the English cotton trade, but are now seldom used in the United States.

Under the broad classification of wool the three classes, merino (fine wool), crossbred (coarse wool), and carpet or native wools have long been in use, have had a rather definite meaning over a long period of time, and are the basis upon which most of our quantitative data are based. "The original distinction underlying the three grades was based upon the breeds of sheep which grew the wool. Today the terms rather denote types of wool without making specific reference to the breeds of sheep, although the wools produced by those breeds still practically conform to the distinction made by the trade." ^{21/}

^{20/} Cotton and Cotton Markets, W. H. Hubbard, 1923, pp. 10-11.

^{21/} World Production and Prices of Merino and Crossbred Wools (MSS)
H. M. Stoker, Ph.D. thesis, Cornell University, 1931, p. 10.

Comparing machine prices is rendered extremely difficult because of the frequent changes in machines, many of which are not apparent from comparative pictures of two machines, but which become apparent **only** through a comparison of the relative efficiencies or serviceability. The spelling of the name is the only thing about some machines which has a high degree of permanence. The shift from horse power to tractor power in the operation of farm machinery, especially where engine power was substituted for ground wheel power in mechanical operation, called for an entirely different type of construction. The newer machines are made of better materials, have greater capacity, and are not as limited in their application. How, then, are we to express the values of a machine over a period of years during which successive changes have been made, so as to have a comparable price series?

The ideal measure would be based on productive efficiency, but the difficulty of securing such a measure, when possible, makes it quite impractical. It is, however, possible to secure a measure of the average capacity and useful life expectancy for most machines. Some of our present machines combine the capacity of two or more of our early machines and render improved service at less expense.

It has been estimated that between 1910-14 and 1932 there was a marked increase in efficiency, durability, and economy of operation of 25 major farm machines, equivalent to an improvement in quality ranging from 30 percent to over 100 percent. 22/

Some agricultural products have also undergone improvements in quality since 1910-14, with a tendency to increase the cost of production. This is true particularly in the case of such cigarette tobaccos as flue-cured and Burley. 23/ To produce the quality of leaf suitable for cigarette manufacture it was necessary for producers of Burley tobacco to shift from high yielding to low yielding varieties. Flue-cured growers changed their harvesting method from stalk-cutting to priming, requiring about three times as much labor for harvesting. In priming, more leaves are retained on the plant than when stalk-cutting, but owing to the requirement of a thinner leaf, the yields per acre have not been increased thereby.

As cigarette tobaccos have undergone a marked change in quality - amounting in fact to a change in the product itself - accompanied by an increase in the cost of production, our pre-war and present prices of these cigarette tobaccos are not really comparable. 24/ It is for this reason that a post-war base (August 1919 to July 1929) is used under the Agricultural Adjustment Act to determine the so-called "parity" price of tobaccos, whereas the pre-war period is used for the several other basic agricultural commodities.

22/ Report of an Inquiry into Changes in Quality Values of Farm Machines Between 1910-14 and 1932, prepared by J. B. Davidson, G. W. McCuen, and R. U. Blasingame; American Society of Agricultural Engineers, St. Joseph, Michigan, June 1933.

23/ Between 50 and 60 percent of the total domestic utilization of these tobaccos is now consumed in the form of cigarettes in contrast to about 6 percent in the pre-war period, 1910-14.

24/ An increase in demand has also contributed to the rise in price of cigarette type tobaccos since 1910-14.

Wages are usually recorded in terms of money because that is by far the easiest way. However, it is real wages (the goods and services that money wages will buy) and the welfare of the laborers which is of vital concern to the workers and to society at large.

In any long historical wage series there is lack of homogeneity and to compare money wages now with those of a century or two ago is largely a waste of time. The increased use of machinery in industry with its accompanying division of labor has increased greatly the number of occupations. Some occupations have experienced a change in nomenclature, whereas others have retained the same name while undergoing a change in composition. The machine process has supplanted some occupations while subdividing some and creating many others. The problem is still further complicated by the fact that similar tasks have different names and vice versa in different parts of the country.

The introduction of machinery into any industry usually alters the proportion of skilled to unskilled workers employed. An average wage, to be significant, must therefore classify workers into homogeneous groups performing similar work under similar circumstances.

In compiling any wage series it is essential to distinguish between the rate of wages and earnings of labor. Wage rates represent the money payment per unit of time worked, whereas earnings represent the total income over a period of time, whether the laborer works full time or only part time. If employment were regular and constant, these two measures would be equal for a given unit of time, but this is seldom the case. Wage rates may be either on the basis of per unit of time worked, as mentioned, or they may be on the basis of per unit of product output, commonly known as piece work.

b - Concerning the Market

(1) Geographical Location

Geographical differences in the market prices of a commodity are the rule rather than the exception. It is therefore important to describe the geographic region or area to which given prices refer and to limit the strict application of such prices to quite homogeneous geographic units. Anyone who takes an automobile trip of 100 to 1,000 miles meets with frequent changes in standard gasoline prices. If we try to satisfy our curiosity as to the reason for these differences we find that differences in transportation costs and State gasoline taxes are not a sufficient explanation. Local price wars may explain extremely low prices and the lack of competition and perhaps the small volume of business helps to explain high prices in some parts of our western plains. No one explanation is sufficient, for several factors are usually operating at one time and the inter-relations of the price-making factors are of a complex nature.

Prices are affected by many factors, some universal and some local. The peculiarities of each local market result in independent price movements of varying degrees. Differences in topography, climate, soil, custom, nationality, religion, competitive conditions, economic condition of consumers, etc., all make for regional differences in prices.

Commodities with a high value in proportion to their cost of transportation normally have less geographical variation in price than do commodities whose cost of transportation is large in proportion to their value. Under monopoly conditions, geographical differences in prices of a given product are apt to be less than under free competition. But under a discriminating monopoly, greater price differences are possible within a given market and between geographically-separated markets.

Sometimes the geographical position is overlooked or mistaken when prices quoted at one place refer to commodities located at another place, for example, Winnipeg prices for wheat at Port Arthur - Fort William.

Zapoleon's study of the "Geography of Wheat Prices" 25/ was the first study of its kind in relation to local market prices of agricultural produce in this country. Holbrook Working's study of "Factors Influencing Price Differentials between Potato Markets" is the same general type of study. 26/

Regional differences in the movement of prices affect, and are in turn affected by, economic and social development. As the railroads pushed westward, prices of farm products increased the greater the distance from the Atlantic seaboard, whereas prices in eastern markets declined relatively, if not absolutely. At the same time prices of manufactured goods were reduced, not only outside the place of production, but there was a general reduction in prices of manufactures as the market area was extended and the volume of output was increased.

A general reduction in transportation costs extends the market area and permits specialization and the production of goods where nature offers the best opportunities for special industries. Railroad rates in the United States often deviate from the distance principle. This tends to equalize the advantages of separate producing-centers and to increase freight traffic. An increase in freight rates, or a great fall in prices of farm products such as we have experienced in 1929-33, tends to restrict market areas and to increase the advantage of producers near to market.

Relative prices, besides being affected by the relative freight rates and cost of transportation, are also affected by variations in transportation privileges allowed in the movement of some commodities from point of origin to destination.

Special privileges in shipping, loading, feeding of livestock, milling of grain in transit, etc., for commodities moving from or through a certain region, or upon a certain railway, will tend to enhance the price of such products where so favored. A peculiar rate combination or privilege of processing in transit, at a through rate or only a minor additional charge, permits wheat shipped from a designated region to command a higher

25/ United States Department of Agriculture, Bulletin No. 594, February 1918.

26/ Journal of Farm Economics, October 1925, p. 377. See also "Factors Determining the Price of Potatoes in St. Paul and Minneapolis", The University of Minnesota Agricultural Experiment Station, Technical Bulletin No. 10, October 1922, by Holbrook Working.

price at a milling center than identical wheat not granted the same privileges. The price-collector should be alert to any such artificial price-determining factors.

In the United States we have sanctioned discriminatory export and import freight rates to facilitate foreign commerce, and the idea of an imperative need for the United States to increase its export trade is used to justify these discriminatory rates. Because of the existing rate structure it is important in price reporting to distinguish products moving at privileged rates from those moving without such privilege.

Besides the long-time changes in regional price differences, we often have marked variations from year to year, which should be carefully noted. This is especially true of local market prices of farm products because the production of farm products is so much influenced by the capriciousness of nature, that an area may be a surplus producer one year and may have a deficit the next year. When such an area is far from market we get wide price variations, amounting to the combined cost of export the first year and the cost of import the next year. To use Professor Fetter's terminology, this area would have changed from a "centrifugal" to a "centripetal" market. 27/

Sometimes a market area may become isolated and prices may become independent of neighboring market areas, for a time. Floods, hurricanes, and war bring about such results. Richmond, for example, was practically an isolated market during the siege in 1864-65. Prices rose to great heights, while prices in nearby territory were affected but little and in southwestern Virginia prices were independent of Richmond prices. 28/

(2) Economic Character of the Market

The economic character of the market in which prices are quoted should be fully described. This can perhaps best be done by defining the economic functions of the buyers and sellers. The farmer, as a seller of farm products, is usually a wholesaler. Sometimes he is also a jobber and in some cases he sells direct to consumers and is then a retailer.

We may think of the movement of farm products from producer to consumer as taking place on a stairway with the successive marketing services taking place each on a higher step, as we ascend stairs. The successive marketing services taking place on the stairway may be broadly outlined as follows:

- Assembling
- Grading and Standardization
- Packing
- Processing and Manufacture
- Transporting
- Storing
- Financial and Risk Taking
- Selling and Distributing

27/ "The Economic Law of Market Areas", Quarterly Journal of Economics, May 1924, pp. 520-29.

28/ Historical Study of Prices Received by Producers of Farm Products in Virginia, 1801-1927, Arthur G. Peterson, 1929, pp. 68, 152. (This bulletin is out of print.)

At each stage in the distributive process, or on each step on the stairway we have a market. The economic function of the sellers and buyers varies according to the stage at which the exchange takes place. Some farmers sell their produce at the foot of the stairway, some on the first step, etc.; a few climbing to the top to sell their products direct to consumers. To the price of our produce at the base is added the value of the successive services rendered and we find the price higher at each successive stage. If our price collector runs up and down the stairway picking prices here and there, and throwing them into the same bag indiscriminately, it is apparent that he does not know what he wants and will not be able to construct a price series which is of much use to anyone. The price collector should study and record what takes place on each step and keep a separate account of the prices at each position chosen in order to obtain adequate price data. A record of prices and sales at each step is especially important for the collector who finds it necessary to construct a series of average or composite local market prices for use in evaluating total crop production or sales of farm products actually disposed of at different steps in the marketing system.

In the economic characterization of the market for which prices are quoted it may be helpful at the outset to distinguish the following general types of markets and their peculiarities: Wholesale or retail, organized or unorganized, cash or futures or both, centralized or local, temporary or continuous, and competitive, monopolized, or publicly regulated.

A price collector should appreciate the complexity and inter-relations of the market and price structure in order to do his task well. A disturbance to prices in some part of our price system may be likened, in its effect, to throwing a stone into a still pond which is filled to overflowing at some points along its irregular border. The disturbance from a small stone thrown in the pond will not be sufficient to reach the edges of the pond. A larger stone will send concentric rings of disturbance which travel on after quiet has been restored in the center. As the ripples in one direction reach the nearby edge, there will be some repercussions. In other directions the ripples will spread to the overflow. The water which flows out, then continues in an uncertain and changing course with the meandering stream.

Not only the size of the rock, but the speed at which it enters the water governs the visible disturbance of the water in the pond. The faster a given mass of stone enters below the water surface the less far-reaching are its visible effects. Here we have unlikeness amid likeness, as Marshall would say. The faster a given price influence enters the minds of the men who determine the prices, the more price-disturbing it is likely to be, for its sudden appearance has not allowed time for a critical evaluation of its importance or the development of counteracting influences. The initial action taken by a few may soon become what Bacon called an "Idol of the Market Place" which gains momentum as it is passed on.

If this was the extent of the complexity of the workings of our price system, it would be relatively simple. To grasp the intricacy of it we must think of many boys, both big and small, throwing different sized stones at various rates of speed from all around the pond. How far the influence of any one splash will extend, depends on its relative size and force, and the interval in space and time between it and all other splashes around.

The point where each stone enters may be likened to a market area. Each is independent in certain respects; the degree of independence decreasing as the radius of the market increases. When opposition is met from another market center we have interdependence and continual arbitration of conflicting interest.

Every boy watches where his stone strikes the water. His attention is centered chiefly on the individual activity resulting from his throw, at least at first. Then his eye follows the inter-activity resulting from the stones which have fallen near by. In the same way we need several boys to watch and record price series which reflect the peculiar price activities in homogeneous areas and to consider their inter-relation with other price series.

c - Concerning the Terms of Sale

(1) The Statistical Nature of the Price

The point or period of time to which a price refers should be specifically stated. On an organized exchange market the opening, high, low, and closing prices are recorded for each day.

In recording an average price it is important to state how the average is computed. Is it an average of the high and low for the day, a simple average of several price quotations, or a weighted average based on the volume of sales? The method of computing any average price, whether for the day, week, month, or year, should be carefully stated.

If a price at some particular time is sometimes selected as representative of an average and referred to as such, for successive periods of time, that fact should always be stated. For example, a price on the first, fifteenth, or last day of each month, or on Wednesday or Friday of each week.

(2) Kinds of Sale

The method of sale of the commodity should be specifically described when recording prices.

Some of the more common methods of sale are as follows:

- | | |
|--|-----------------------|
| (1) F.o.b. | origin or destination |
| (2) "on track" | |
| (3) "on tree" | |
| (4) delivered | (|
| (5) future delivery | (state time and place |
| (6) "to arrive" | (|
| (7) on consignment | (|
| (8) under contract | |
| (9) with a guarantee against price decline | |
| (10) by auction | |

Some of these various methods of sale represent differences in marketing services or different stages in the process of distribution as discussed in connection with the economic character of the market.

In the case of imported commodities, prices sometimes include tariff duties and other times they do not. Prices quoted as "in bond" or "c.i.f. (cost, insurance and freight) New York" do not include the import duty. If prices include duty they are often described as "duty paid". If the prices refer to products which are allowed certain transit privileges, that fact should be noted in connection with the price quotations.

Differences in the method of sale may be small or they may have an element of secrecy and are, therefore, harder to detect. These differences give rise to apparent rather than real differences in prices within the same market and it is very important that the price collector determine what a given price represents at all times. In instances where it is necessary to construct average price series covering two or more methods of sale for the determination of cash income from farm products, method of sale as a legitimate variant in the determination of average prices should be recognized, and such average price series presented with an appropriate description of their composite nature.

List prices are often little or no indication of the actual prices paid or received; in fact, list prices may be very misleading to those not familiar with such practice. Chain discounts are frequently associated with list prices. In March 1933 ground-joint unions, for example, were being sold at a "base" discount of 90 percent off list price, plus 5 percent for cash. An item with a list price of \$1.00 was thus actually selling for $9\frac{1}{2}$ cents cash. Cast-iron sewer pipes were being sold for list price less the following percentage discounts: $79\frac{1}{2}$, 10, 10, 5, and 5 for cash, or "less $79\frac{1}{2}$, 2-10's, and 2-5's".

Contract prices vary with the time of delivery and the terms of the contract. With long contracts, especially if marked price changes occur, evasions are frequent. Contract prices contain an element of forecast as to future price trends and are, therefore, of questionable value as a basis for compiling a continuous price series. Many so-called wholesale prices used in price series and index numbers are not wholesale prices in the strict sense, but are in reality contract prices.

The widespread application of sales and use taxes introduces another difficulty in comparing long-time price series. If such taxes are imposed, the amount of the tax, whether or not it is included in the reported price, and, if possible, the incidence of the tax should be carefully noted. A small tax may be absorbed by the seller whereas a 2 percent sales tax added to a 5-cent article might amount to 1 cent or 20 percent unless tax tokens of smaller denomination than 1 cent are available.

(3) Credit Terms

Deviations from cash prices at time of delivery should be noted.

The probable influence on the quoted price should be determined as accurately as the price collector can within the limits of what in his judgment seems practical.

If the trading basis and the prices quoted are based on a customary credit period such as 10 to 30 days, with a discount for cash payment, then the cash prices should be kept separately.

Variations in credit terms tend to destroy the comparability of quoted prices, and it is very difficult to make the proper allowance for these variations because of their multiplicity. The customary wholesale transactions in some lines of business allow 10 to 30 days in which to make payment, with a discount for cash or payment within a certain number of days. After the Civil War there developed a tendency for distributors to reduce the period within which payment was due. Buyers have since turned more and more to the banks for credit to finance their business and the wholesale trade is now more nearly on a cash transaction basis.

A Nation-wide survey of mercantile credit by the United States Department of Commerce in 1930 indicates that the most common credit terms offered by manufacturers and wholesales are, in their order of importance, as follows: 2 percent 10 days, net 30 days; no cash discount, net 30 days; 2 percent 10th proximo, net 30 days; 1 percent 10 days, net 30 days; 2 percent 10 days, net 60 days. 29/

About 54 percent of the reporting firms commonly used one of these six credit terms. The other 46 percent reported a large number of varied credit terms. Uniform installment terms, by themselves, or as a part of national industrial codes, will help to increase the comparability of commodity price data, as indicated by the following example:

"Retailers and jobbers of electric appliances have entered into (a tentative) agreement fixing uniform terms of installment sales in the Atlantic area, according to Retailing (July 10, 1933).

"The (proposed) agreement fixes a maximum of 24 months for installments on electric refrigerators selling for \$175 or less, prohibits the acceptance of non-electric refrigerators on trade-ins, limits trade-ins on electric refrigerators to the resale value, sets a minimum down payment of \$10 or 10 percent, whichever is greater, fixes the minimum monthly payment at \$5 and the minimum carrying charge at 9 percent." 30/

Retail prices are sometimes higher if goods are sold on credit and higher prices are usually charged on installment purchases. The practice varies with the individual business. Furniture, for instance, is largely sold at retail on credit, and installment prices perhaps average about 16 percent higher than cash prices. 31/ When no interest or its equivalent is charged on credit sales, or no discount is allowed for cash payment, prices will necessarily be higher on the average, the greater the proportion of

29/ Domestic Commerce, Bureau of Foreign and Domestic Commerce, Washington, July 10, 1933, p. 3. Complete survey published in Domestic Commerce Series No. 74, 77, 78.

30/ Domestic Commerce, published by the Bureau of Foreign and Domestic Commerce, July 20, 1933, p. 15.

31/ Federal Trade Commission, Report on House Furnishings Industries, Vol. 1, Household Furniture, 1923, pp. 16-18.

credit sales. In earlier years a retail merchant could vary the amount or quality of an order so as to allow for the credit extended to certain customers. This type of discrimination has been made more difficult with the increased standardization and packing of consumers' goods, and weights and measures regulations.

Credit terms are so variable that about all the advice one can give to a price collector is to point out the variations and their influences on quoted prices. Each case requires a separate study to determine the prevailing practice or practices and how the prices are influenced thereby.

(4) The Volume of Transactions Represented by the Quotations

A reasonable attempt should be made to ascertain, or at least to estimate, the volume of transactions at the recorded prices, whenever the volume of trading is an important factor in price sampling or averaging.

For commodities bought and sold on the organized exchanges, records are generally kept of the volume of sales at particular prices and it is comparatively easy to compute a weighted average price for a month, a week, or even a day. Whenever the price of a commodity is subject to rapid fluctuations, or if considerable price differences exist within a grade, or between grades, it is very desirable to have data as to the volume of sales at the various prices. The more standardized an article is, the less need there is for weighting prices by sales in order to give comparability to such a commodity price series.

In averaging prices for a period of time such as a month or year, it is often desirable to weight the monthly or daily prices by the volume of sales, especially if the prices are to be used as an indication of income. Such data as receipts, shipments, monthly marketings, sales tax receipts, and changes in storage stocks are helpful in computing weighted average prices, in the absence of more direct measures.

Prices of some commodities such as bread, and retail milk usually remain unchanged for considerable periods at a time. The volume of sales is not needed in order to compile a comparable price series of standard commodities in such cases, although they would be desirable for studying changes in production, consumption, and demand. 32/

C - Summarization of Price Data

Summarization of the price data is one of the most important tasks of the research worker. He must be able to consolidate the significant data in a condensed and useful form so that they can be readily interpreted. 33/

32/ See discussion p. 5.

33/ Index numbers have become increasingly important as a means of averaging and summarizing prices and other statistics. A discussion of index numbers is beyond the scope of this report and may be found in numerous books and other publications.

Editing

Before the summarization it is usually necessary to edit the data to secure uniformity and completeness in the various price schedules, to discover errors and inconsistencies, and to discard irrelevant and questionable materials. The extent to which it is desirable or permissible to interpolate or extrapolate missing data depends largely on the objectives of the study - whether or not a complete record is needed - and on the availability of check data upon which to base estimates for the missing data.

If the price collector has analyzed the distribution of prices by grades and has established normal price differentials he can perform a valuable service by estimating a nominal price in case no sales or a skewed distribution of a few sales of a particular grade are made on a given day. The average price of hogs sold at Chicago on Saturday offers such an example. The week-end sales usually consist of a clean-up of mostly low grade hogs. The average price of Saturday sales is therefore relatively low, but the lower average price represents an apparent rather than a real drop in price, except insofar as prices of identical grades have declined. By comparing the changes in prices of the grades sold on Saturday with comparable prices on other week days, a comparable average price could be computed for Saturday.

Editing the data should be done in part by the field man on the day the price schedule is secured, or as soon thereafter as possible. The data should then be edited by the person in charge of the project, with the assistance of the field man if possible. The last phase of the editing before summarization should accompany the clerical tabulation of the data. This can best be done when all the records are available for comparison, and particular attention should be given to checking for errors. 34/

Conversions

Particular attention should be given to the problem of making conversions from one unit to another and to state the conversion factor used. In converting prices per bushel to prices per barrel, or prices per gallon to prices per 100 pounds, be sure that the prices in the separate units are comparable. Prices listed in short tons, long tons, or metric tons are usually comparable when converted to a common base, but widely different units frequently are associated with prices which represent marked differences in quality of goods or in services rendered, and which should not as a general rule be thrown together by conversion.

Conversions to comparable units, where desirable and justifiable, should generally be made before the data are published, for it is more economical and a means of avoiding errors not to have each user make his own conversions. Conversion of inflated currency prices to gold prices should be made before publication. During periods of currency inflation such as occurred in the United States, 1862-1873, and in England during the period of the Bank Restriction Act, and after the suspension of the gold bullion

34/ For reference see Research Methods and Procedure in Agricultural Economics, op. cit., Vol. I, pp. 140 f.f.

standard in September 1931, prices should be given both in inflated currency and on a gold basis. Currency prices are the most useful and the most used within the country in regard to the present. In a historical comparison, prices on a gold basis may be the most valuable. The prices which are to be preserved for permanent record should therefore be converted to a gold basis so that both currency and gold prices may be recorded.

From the standpoint of the competitive relations between certain commodities entering into trade between Great Britain and the United States, we are interested in British prices in terms of gold. If, on the other hand, we in the United States are trying to estimate the purchasing power of British consumers, as affecting British imports of American goods, we are more particularly interested in British currency prices of consumption goods in relation to wages and rents in Great Britain, especially during transition periods.

During periods of currency inflation, prices are usually quoted in terms of depreciated currency rather than in terms of gold dollars, because depreciated currency is about the only money used in domestic transactions at such times. There are marked variations in the degree of depreciation in currency and the rapidity with which prices in different localities, and of various products in the same locality, are adjusted to the changed conditions. The whole price structure is thrown into disequilibrium by a rapid change in the value of money. To deflate local depreciated currency prices by available data of gold values of currency in New York, for instance, may introduce more error into the prices so deflated than there is in the undeflated prices.

Dunn's index of prices and Fisher's weekly index are made up almost entirely of New York market prices. There is a considerable lag between New York price changes and adjustment of prices in the mountains of Tennessee, if the adjustments ever permeate that far. The amplitude and rapidity of price fluctuations in New York City is perhaps greater than in any other city and an index of New York prices cannot, therefore, fairly be used to deflate prices in remote regions. Even if prices at Cumberland-Gap were fully responsive to New York prices, the price movements in the two places would likely be far from synchronous.

The problem of converting prices to uniform units of purchasing power should be left to the price analyst who is better able to select the deflator (index number) which is best suited to his particular problem.

Before making conversions of similar price series quoted in different units, one should examine the price data carefully. Converting two price series to a uniform price per unit can be justified only when the sole dissimilarity between the two series is in the unit which is being converted. If the price series differ in other respects, that is, if they represent different quality products or differing amounts of services rendered, then we are not justified in uniting these unlike price series, unless we are attempting to obtain an average price for all qualities of a product. 35/

Averaging

Averaging is a means of simplifying and summarizing quantitative data by a single figure. An average, however, is not alone sufficient to characterize a frequency distribution. In addition, we need to employ a measure of dispersion and a measure of skewness.

"Obviously the scientific basis of price-quoting involves sampling, frequency distribution, and averages. The problem calls for a very thoroughgoing and careful application of these principles Ideally one should have enough quotations for any area at any period of time to make a good sample and frequency distribution. Practically this is very difficult and often impossible." 36/

A measure of dispersion is designed to indicate the degree of variation or scatter in our data as an indication of how well our average typifies a given statistical group. A measure of skewness is designed to tell us the degree of asymmetry or the extent to which our distribution deviates from a normal asymmetrical frequency distribution. In addition to these three measures - an average, a measure of dispersion - and a measure of skewness, F. C. Mills includes a measure of kurtosis in describing frequency distributions. A measure of kurtosis indicates the extent to which the data in a given frequency distribution tend to group themselves around the mid-point of the distribution. In other words, it measures the peakedness of a given distribution in relation to a normal frequency distribution. 37/

Let us look back to our illustration of the frequency distribution on page 8. Our average of 13 gives us a summary which in this case is quite typical of our distribution. It falls in the middle of the range of our data which extends from 9 cents to 17 cents. In addition, this average is also the mode, or most typical price.

The average might still have been 13, if the range of prices had been from 1 to 14 or from 1 to 25 or more, but the average would then have been less typical of the frequency distribution. That is why we also need measures of dispersion and skewness to tell how typical our average is, and the degree of symmetry or asymmetry of our frequency distribution.

The coefficient of variation, standard deviation, and the mean (or average) deviation are perhaps the most useful measures of dispersion. The relative probable error, range, and quartile deviation are also useful measures of dispersion. The measurement of skewness and the various measures of dispersion and their relative merits are discussed in most of the standard textbooks on statistics. 38/

36/ John D. Black, Research in Prices of Farm Products, Journal of Farm Economics, January 1928, pp. 46-47.

37/ F. C. Mills, Op. Cit., pp. 110, 147, 168.

38/ See: F. C. Mills, Ibid., Chs. III-V, especially pp. 161-64; G. W. Yule, Op. Cit., Chs. Vi, VIII; Bowley, A. L., Elements of Statistics, 5th edition, 1926, pp. 82-124; E. E. Day, Statistical Analysis, 1925, Ch. IX, XI.

Averages may be classed into two groups: those which, as the arithmetic mean, are affected by every unit of the statistical group and are subject to algebraic manipulation, and those which, as the mode and median, are determined by the number or position of certain items in the group. The arithmetic mean is the most common and most useful type of average. The mode and median rank next; while the geometric mean and harmonic mean are well adapted for certain rather limited problems, but are not readily comprehensible. ^{39/} Yule lists six characteristics of a good average, and then he goes on to say: "The arithmetic mean should invariably be employed unless there is some very definite reason for the choice of another form of average, and the elementary student will do very well if he limits himself to its use." ^{40/}

A simple average (sometimes referred to as unweighted) weights equally all items in a group, regardless of the relative importance of the items. Where frequency of occurrence determines the relative importance of differing values of the variable in question, a simple average for a representative sample will become self-weighted. If, on the other hand, we have selected one price at a given time each month to represent the average monthly prices of potatoes, it would be necessary to weight the varying monthly prices by the respective quantities marketed each month, in order to get a representative average price for the year. With the marked increase in data available for weighting sample series, the weighted arithmetic average, because of its usual superiority, is being used more and more in place of the simple arithmetic average.

The significance of different methods of computing average prices is well brought out in an article by Mr. C. R. Fay on "Price Control and the Corn Averages Under the Corn Laws." ^{41/}

Corn prices were needed for setting the Assize of Bread until about 1800, and for determining the duties and bounties on corn. From about 1770 to 1792 England imported wheat some years and exported other years. The duty or bounty was regulated independently in the Twelve Maritime Districts. Some districts imported at the same time others exported.

In 1804 a simple average of the 12-district average as a national average was substituted as a base for determining the tariff or bounty; which at the same time removed the last obstacle to the freedom of internal trade. These averages were adjusted every 6 weeks and in 1827 a 6-weeks' moving average was computed every week. Because a simple average of 12 districts was used, affected interests would manipulate the averages in the districts where little trade was carried on.

^{39/} For further discussion of characteristics of the various types of averages, see: Yule, *Ibid.*, Ch. VII; Bowley, *Ibid.*, Ch. V; Day, *Ibid.*, Ch. X; Research Methods and Procedure in Agricultural Economics, Vol. I, pp. 152-56.

^{40/} Yule, *Ibid.*, p. 123.

^{41/} *Economic Journal* (Supplement) *Economic History* No. 1, January 1926, pp. 149-154.

"If the repeal of the Corn Laws did nothing else, at any rate it abolished a profession from which the country derived no benefit and which in 1846 was said to be very popular along the coast of Norfolk -- the profession of 'working the averages'." 42/

In computing averages it is fundamental to have an understanding of the objective. What type of variability do we wish to measure: day to day, week to week, month to month, or etc.? Variations in prices during a year include a composite of secular, cyclical, seasonal, and accidental changes. An average price of potatoes for the United States, for example, represents a composite of local price changes of varying magnitude and direction, and is perhaps not representative of any one market. To make our average price quotation most useful it is, therefore, necessary first to determine our objective, and second, to divide the field of inquiry sufficiently so as to secure the necessary homogeneity in our basic data.

We may think of our universe or field of inquiry as having three dimensions: time, space, and form. In dividing this field it is easy enough to vary the time element. The discussion of the geographical location and economic character of the market in this paper is designed to aid in dividing the space element, and the discussion of units and description of commodities is designed to aid in dividing the form element, so as to secure the necessary homogeneity and to afford price data which fit each peculiar need.

42/ Ibid., p. 154.

